

Extraction and characterization of pectin from the peel powder of *Aloe barbadensis*

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Abstract: In this study, pectin was extracted from aloe peel dried powder using acid extraction and alcohol precipitation method. The results showed that the amount of acid-insoluble ash, galacturonic acid, the loss on drying of pectin was 12.72%, 10.791% and 9.48%, respectively. There were several monosaccharides in the pectin, with the amount order of mannose > glucose > galactose > arabinose > rhamnose > fucose. This suggests that the method was suitable for the extraction of pectin from the aloe peel, but it still needs to be improved. Furthermore, the obtained aloe pectin had obvious ability of anti-oxidant, indicating that it might be a promising material for food and medicine. Our study will pave a new way for handling the aloe peel resource in the future.

1. Introduction

Aloe (*Aloe barbadensis*) is a plant which has been widely used as food or medicine. However, aloe peel has been discarded during the process of aloe into food or medicine, resulting in the waste of resource and pollution to the environment. How to handle the aloe peel has become an issue in the aloe culture industry. It has been shown that aloe pectin was widely used as thickener, emulsifier, gel, stabilizer, etc. In this study, the pectin from aloe peel was extracted by acid extraction and alcohol precipitation method [1]. The ingredients and the anti-oxidation activity of the extracted pectin have been elucidated.

2. Materials and methods

2.1. Materials and equipment

The peel powder of *Aloe barbadensis* was provided by an aloe plant company in Guangdong province, China. The main chemical reagents used in the experiments were as follows: hydrochloric acid, anhydrous ethanol, salicylic acid, ferrous sulfate, hydrogen peroxide, ammonium persulfate, sodium nitrate, trifluoroacetic acid, acetonitrile, phosphate. The equipment of the experiments included



analytical balance, chromatograph, multi-function mill, ultraviolet spectrophotometer, acidity meter, centrifuge, rotary evaporator, dryer and pump.

2.2. The extraction and the ingredients of pectin from aloe peel

The pectin was extracted from aloe peel powder by acid extraction and alcohol precipitation method according to Chinese National Standard (GB 25533-2010). Thereafter, the main ingredients in the extracted were measured [2-4].

2.3. The anti-oxidant activity of the extracted pectin

The anti-oxidant activity of the extracted pectin was measured by two methods [5-8]. The clearance of hydroxyl radical ($\cdot\text{OH}$) and the clearance of ABTS⁺ of pectin was tested by Fenton action method and ultra-violet method, respectively.

3. Results and analysis

3.1. The physical and chemical features of extracted pectin

As shown in Table 1, by the acid and alcohol precipitation extraction method [3], the amount of acid-insoluble ash, galacturonic acid, the loss on drying of pectin was 12.72%, 10.791% and 9.48%, respectively. The amount of acid-insoluble ash was higher and the amount of galacturonic acid was less than those proposed by the Chinese National Standard, indicating that the extraction method still needs to be optimized.

Table 1. Physical and chemical features of the pectin from aloe peel.

Indexes	Used method	GB 25533-2010
Acid-insoluble ash/%	12.72	≤1
Galacturonic acid/%	10.791	≥65
The loss on drying of pectin/%	9.48	≤12

3.2. The molecular weight distribution of extracted pectin

To test the purity of the obtained pectin, the molecular weight of the pectin was tested by HPLC. The result showed in Table 2 that there were several molecular weights with distinct values in the pectin, indicating that the pectin was not a pure chemical compound.

Table 2. Molecular weights distribution of aloe pectin.

Indexes	Aloe pectin		
Amount average of molecular weight/ Mn	232621	13111	2699
Heavy average of molecular weight /Mw	1.015e6	17102	3097
Average molecular weight/ Mz	3.153e6	21553	3415
Summit molecular weight/ Mp	452497	18556	3461

3.3. The monosaccharide composition of pectin

To further elucidate the compositions in pectin, the monosaccharides in the pectin were subjected to further analyzed. As shown in the Figure 1, 2 and Table 3, there were several monosaccharides in the pectin, with the amount order of mannose > glucose > galactose > arabinose > rhamnose > fucose.

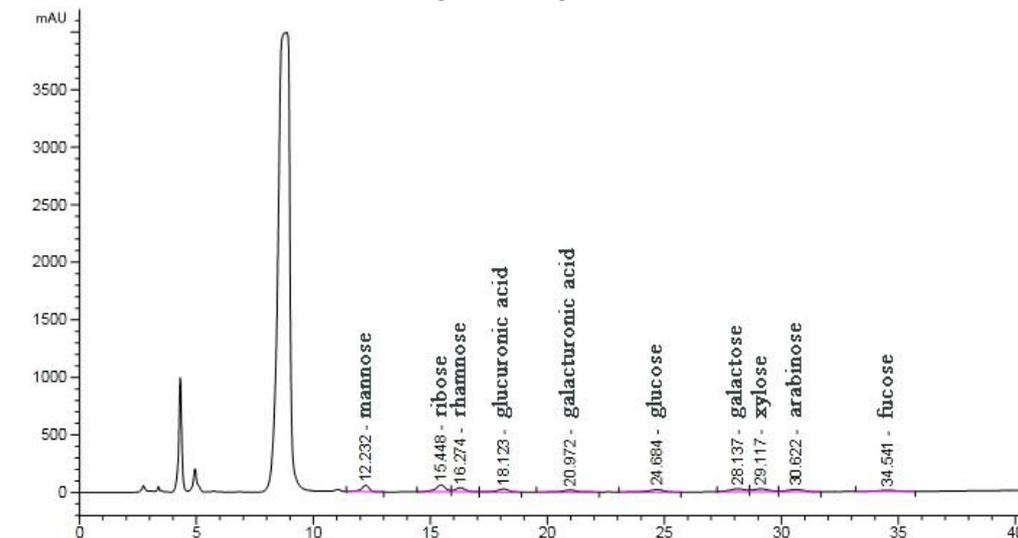


Figure 1. The HPLC chromatogram of internal standard monosaccharide.

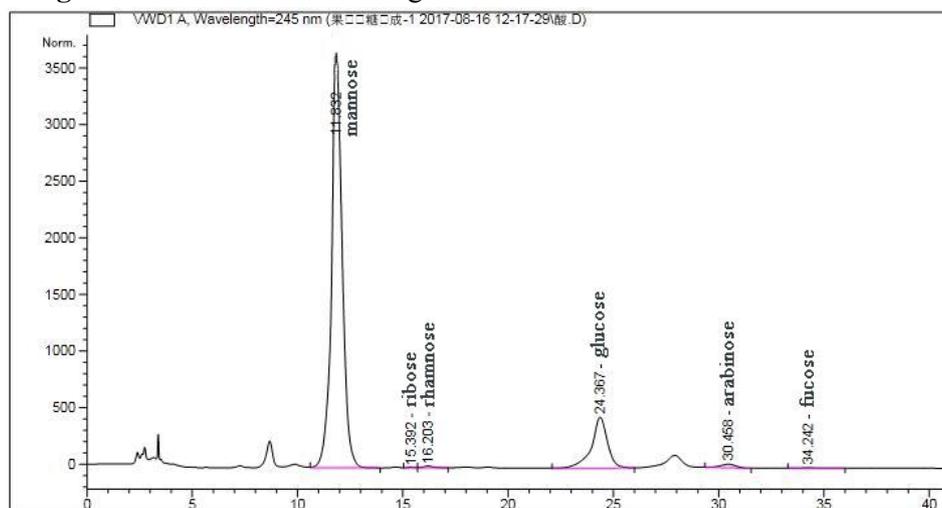


Figure 2. The HPLC chromatogram of the pectin.

Table 3. The monosaccharide composition of pectin.

contents (mg/Kg)	mannose	rhamnose	glucose	galactose	arabinose	fucose
Alone pectin	110453.40	414.00	21580.47	4368.87	1667.17	391.49

3.4. The anti-oxidant activity of the extracted pectin

The clearance of hydroxyl radical (OH) of pectin was shown in Figure 3, the results showed that the clearance ability of $\cdot\text{OH}$ was pectin dose dependent, with 61.17% of ability of reducing $\cdot\text{OH}$ when the pectin concentration was at 10 mg/mL.

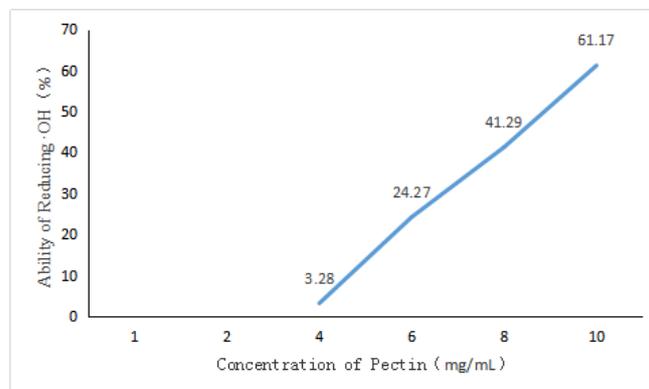


Figure 3. The clearance of hydroxyl radical of pectin.

Furthermore, the clearance of ABTS⁺ of pectin was shown in Figure 4, the results showed that the clearance ability of ABTS⁺ was also pectin dose dependent, with 19.59 % of ability of reducing ABTS⁺ when the pectin concentration was at 1mg/mL. All above results showed that the aloe pectin had obvious anti-oxidant ability.

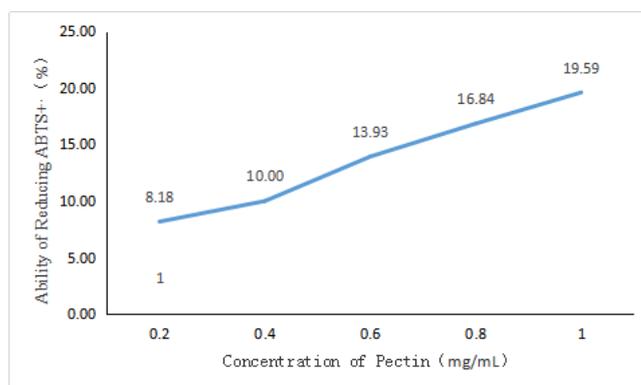


Figure 4. The clearance of ABTS⁺ of pectin.

4. Discussion and conclusion

In this paper, the pectin from aloe peel was extracted by the acid extracting and alcohol precipitation method. However, this method still needs to be improved so as to meet the Chinese national standard. The main contents of the pectin were tested, and the results showed that there are several monosaccharides in the pectin. Furthermore, the aloe pectin had obvious ability of anti-oxidant, indicating that it might be a promising material for food and medicine. Our study will pave a new way for handling the aloe peel resource in the future.

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